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EXAMINER	
STULTZ, JESSICA T	

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2873	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	**Application No.** 10/677,825	**Applicant(s)** MONROE ET AL.
	Examiner Jessica T Stultz	**Art Unit** 2873

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-45 is/are pending in the application.
 4a) Of the above claim(s) 1-14 is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) 15-45 is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on 02 October 2003 is/are: a)☒ accepted or b)☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a)☐ All b)☐ Some * c)☐ None of:
  1.☐ Certified copies of the priority documents have been received.
  2.☐ Certified copies of the priority documents have been received in Application No. _____.
  3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date 1003.
4) ☐ Interview Summary (PTO-413)
 Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-14, drawn to method of making a MEMS device, classified in class 359, subclass 290.

II. Claims 15-45, Claims 28-45 are drawn to micro-mirror device classified in class 359, subclass 247. Claims 15-27 are grouped with these claims because they disclose a method of making a micro-mirror device including the limitations of claims 28-45 and therefore would not require an additional search and therefore would not cause undue burden on the examiner.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the process as claimed can be used to make other and materially different products. Specifically, regarding Group I and claims 15-27 of Group II, the method of making a MEMS device can be used to make a product that does not include a reflective layer formed over the sacrificial silicon layer. Regarding Group I and claims 28-45 of Group II, the method of making a MEMS device can be used to make a product that does not include a reflective element extended over a dielectric layer and an electrode, wherein the reflective element is adapted to move in response to application of an electrical signal to the at least one electrode.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for any one group is not required for any other group, restriction for examination purposes as indicated is proper.

During a telephone conversation with Timothy Myers on August 18, 2004 a provisional election was made with traverse to prosecute the invention of Group II, claims 15-45. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-14 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 28-30, 37, and 39-42 are rejected under 35 U.S.C. 102(e) as being anticipated by Ishii et al.

Regarding claim 28, Ishii et al discloses a micro-mirror device (Sections 1-2 and 36-39, wherein the micro-mirror device, i.e. an optical switch with micro-mirrors, is shown in Figures 1A-C and 2), comprising: a substructure including a base material and at least one conductive layer formed on a side of the base material (Sections 55-60, wherein the base material is semiconductor substrate "101", wherein the conductive layer is the top layer with connection electrodes "103", Figures 1A and 3A-C); a dielectric layer formed over the at least one conductive layer of the substructure (Sections 55-60, wherein the dielectric material is layer "102", Figures 1A and 3A-C); at least one electrode formed on the dielectric layer (Sections 61-66 and 74-78, wherein the control electrodes "140" comprise electrodes "141-145", Figures 4A-E and 7A-D); and a reflective element extended over the dielectric layer and the at least one electrode (Sections 74-78, wherein the mirror portion "131" is formed over sacrificial layers "401-405", Figures 7A-D), the reflective element including a hinge material and a reflective material formed on the hinge material (Sections 74-78, wherein the hinge material is seed layer "406", Figures 7A-D), wherein the reflective element is adapted to move in response to application of an electrical signal to the at least one electrode (Sections 43-45, wherein the control electrodes "140" control the pivotal operation of the mirror "131", Figure 1A).

Regarding claim 29, Ishii et al further discloses that the hinge material of the reflective element is adapted to flex to move the reflective element (Sections 43-45 and 74-78, wherein the layer "406" pivots with the mirror "131", Figures 1A and 7D).

Regarding claim 30, Ishii et al further discloses an electrical contact area for the micro-mirror device (Sections 55-60, wherein the electrical contact area is formed by interconnection layer "104" and electrode "103", Figures 1A and 3A-C), including forming an opening through the dielectric layer to the at least one conductive layer of the substructure (Sections 55-60, wherein the interconnection layer "104" is electrically connected to electrodes "103" through dielectric layer "102", Figures 1A and 3A-C).

Regarding claim 37, Ishii et al further discloses the substructure including a complementary metal oxide semi-conductor structure (Sections 55-56, wherein the substrate "101" includes a CMOS circuit, Figures 1A and 3A-C).

Regarding claim 39, Ishii et al further discloses that the dielectric material includes silicon oxide (Section 55, wherein the dielectric material "102" includes silicon oxide, Figures 1A and 3A-C).

Regarding claim 40, Ishii et al further discloses that the micro-mirror device is in a display device (Sections 1-2 and 36-39, wherein the micro-mirror device, is held in an optical switch, shown in Figures 1A-C and 2).

Regarding claim 41, Ishii et al discloses a micro-mirror device (Sections 1-2 and 36-39, wherein the micro-mirror device, i.e. an optical switch with micro-mirrors, is shown in Figures 1A-C and 2), comprising: a substructure including a base material and at least one conductive layer formed on a side of the base material (Sections 55-60, wherein the base material is semiconductor substrate "101", wherein the conductive layer is the top layer with connection electrodes "103", Figures 1A and 3A-C); a dielectric layer formed over the at least one conductive layer of the substructure (Sections 55-60, wherein the dielectric material is layer

"102", Figures 1A and 3A-C); at least one electrode formed on the dielectric layer (Sections 61-66 and 74-78, wherein the control electrodes "140" comprise electrodes "141-145", Figures 4A-E and 7A-D); and a reflective element extended over the dielectric layer and the at least one electrode (Sections 74-78, wherein the mirror portion "131" is formed over sacrificial layers "401-405", Figures 7A-D), including means formed in the reflective element for facilitating movement of the reflective material (Sections 74-78, wherein the means is seed layer "406", Figures 7A-D), in response to application of an electrical signal to the at least one electrode (Sections 43-45, wherein the control electrodes "140" control the pivotal operation of the mirror "131", Figure 1A).

Regarding claim 42, Ishii et al further discloses that the means for facilitating movement of the reflective elements includes a hinge material (Sections 74-78, wherein the means is seed layer "406", Figures 7A-D) and a reflective material formed on the hinge material (Sections 74-78, wherein the reflective material "702" is formed on hinge material "406", Figures 7A-D), wherein the hinge material is adapted to flex to facilitate movement of the reflective element (Sections 43-45 and 74-78, wherein the layer "406" pivots with the mirror "131", Figures 1A and 7D).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 15-27, 31-36, 38, and 43-45, are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al in view of Brosnihhan et al.

Regarding claims 15, 19, 31-32, and 43 Ishii et al discloses a micro-mirror device and method of forming a micro-mirror device (Sections 1-2 and 36-39, wherein the method of making micro-mirror device shown in Figures 1A-C and 2, i.e. an optical switch with micro-mirrors, is disclosed in Figures 3A-C, 4A-E, 5AE and 7A-E), the method comprising: providing a substructure including a base material and at least one conductive layer formed on a side of the base material (Sections 55-60, wherein the base material is semiconductor substrate "101", wherein the conductive layer is the top layer with connection electrodes "103", Figures 1A and 3A-C); forming a dielectric material over the at least one conductive layer of the substructure (Sections 55-60, wherein the dielectric material is layer "102", Figures 1A and 3A-C); depositing a conductive material on the layer of dielectric material (Sections 55-60, wherein the conductive material is interconnection layer "104", Figures 1A and 3A-C), including communicating the conductive material with the at least one conductive layer substructure through the layer of dielectric material (Sections 55-60, wherein the interconnection layer "104" is electrically connected to electrodes "103" through dielectric layer "102", Figures 1A and 3A-C); forming a sacrificial layer over the conductive material and the layer of dielectric material (Sections 61-69, wherein the sacrificial layers are "401-405", Figures 4A-E and 5A-E); forming a reflective element over the sacrificial layer (Sections 74-78, wherein the mirror portion "131" is formed over sacrificial layers "401-405", Figures 7A-D); and substantially removing the sacrificial layer between the reflective element and the layer of dielectric material (Sections 74-78, wherein the sacrificial layers "401-405" are removed, Figures 7A-D), but does not specifically disclose that the sacrificial layer is made of silicon or that the sacrificial layer is removed by dry etching. However, Brosnihhan et al teaches of a method of making a micro-mirror device including forming a providing a substructure including a base material (Sections 25-34, wherein the base material is substrate "200", Figures 2A-J); forming a dielectric material over the substructure (Sections 25-34, wherein the dielectric material is layer "203", Figures 2A-J); forming a sacrificial layer of silicon over the layer of dielectric material (Sections 25-34 and 14, wherein the sacrificial layer is "222", Figures 2A-J); forming a reflective element over the sacrificial layer of silicon (Sections 25-34, wherein the mirror portion is "210", Figures 2A-J); and substantially removing the sacrificial layer of silicon between the reflective element and the layer of dielectric material by dry etching (Section 33, wherein the sacrificial layer "222" between the dielectric layer "205" and mirror "210" is removed) for the purpose of providing the appropriated interconnects between the mirror and the dielectric material and to form a cavity between them (Sections 25-34). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the sacrificial material used in Ishii et al to be silicon since Brosnihhan et al teaches of a method of making a micro-mirror device including forming a providing a substructure including a base material; forming a dielectric material over the substructure; forming a sacrificial layer of silicon over the layer of dielectric material; forming a reflective element over the sacrificial layer of silicon; and substantially removing the sacrificial layer of silicon between the reflective element and the layer of dielectric material for the purpose of providing the appropriated interconnects between the mirror and the dielectric material and to form a cavity between them.

Regarding claim 16, Ishii et al and Brosnihhan et al disclose and teach of a method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses the step of depositing forming at least one electrode on the layer of dielectric material (Sections 61-66 and 74-78, wherein the control electrodes "140" comprise electrodes "141-145", Figures 4A-E and 7A-D) wherein the reflective element is adapted to move in response to application of an electrical signal to the at least one electrode (Sections 43-45, wherein the control electrodes "140" control the pivotal operation of the mirror "131", Figure 1A).

Regarding claim 17, Ishii et al and Brosnihhan et al disclose and teach of a method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses that the step of forming the reflective element includes depositing a hinge material over the sacrificial layer of silicon (Sections 74-78, wherein the hinge material is seed layer "406", Figures 7A-D), depositing and patterning a protective material over the hinge material (Sections 74-78, wherein the protective material is resist pattern "701", Figures 7A-D), and depositing a reflective material over the protective material and the hinge material (Sections 74-78, wherein the reflective material is metal layer "702", Figures 7A-D), and includes removing a portion of the reflective material and the protective material to expose a portion of the hinge material (Sections 74-78, shown in Figures 7A-D).

Regarding claims 20 and 33, Ishii et al and Brosnihhan et al disclose and teach of a micro-mirror device and method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses forming a first layer of barrier material over the conductive material and the layer of dielectric material (Sections 55-60, wherein the first barrier material is "106" Figures 3A-C), wherein forming the sacrificial layer includes forming the sacrificial layer over the first layer of barrier material (Sections 61-66, wherein the sacrificial layers "401-405" are formed over the first barrier layer "106", Figures 4A-E), and wherein substantially removing the sacrificial layer includes substantially remove the sacrificial layer and the first layer of barrier material between the reflective element and the layer of dielectric material (Sections 74-78, wherein layers "106" and "401-405" are removed, Figures 7A-D).

Regarding claims 22 and 35, Ishii et al and Brosnihhan et al disclose and teach of a micro-mirror device and method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses forming a second layer of barrier material over the sacrificial layer (Sections 74-78, wherein the second barrier material "406" if formed over sacrificial layers "401-405", Figures 7A-ED), wherein forming the reflective element includes forming the reflective element over the second layer of barrier material (Sections 74-78, wherein the reflective element "131" is formed over the second barrier layer "406", Figures 7A-D), and wherein substantially removing the sacrificial layer includes substantially remove the sacrificial layer and the second layer of barrier material, the sacrificial layer, and the first layer of barrier material between the reflective element and the layer of dielectric material (Sections 74-78, wherein layers "401-405", and sections of "106" and "406" are removed, Figures 7A-D).

Regarding claim 24, Ishii et al and Brosnihhan et al disclose and teach of a method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses defining an electrical contact area for the micro-mirror device (Sections 55-60, wherein the electrical contact area is formed by interconnection layer "104" and electrode "103", Figures 1A and 3A-C), including forming an opening through the dielectric layer to the at least one conductive layer of the substructure (Sections 55-60, wherein the interconnection layer "104" is electrically connected to electrodes "103" through dielectric layer "102", Figures 1A and 3A-C).

Regarding claim 25, Ishii et al and Brosnihhan et al disclose and teach of a method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses the substructure including a complementary metal oxide semi-conductor structure (Sections 55-56, wherein the substrate "101" includes a CMOS circuit, Figures 1A and 3A-C).

Regarding claim 27, Ishii et al and Brosnihhan et al disclose and teach of a method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses that the dielectric material includes silicon oxide (Section 55, wherein the dielectric material "102" includes silicon oxide, Figures 1A and 3A-C).

Regarding claims 18, 26, and 38, Ishii et al and Brosnihhan et al disclose and teach of a micro-mirror device and method of manufacturing a micro-mirror device as shown above and Ishii et al further discloses that the base material of the substructure includes silicon (Section 55, wherein the substrate "101" includes silicon, Figures 1A and 3A-C) wherein the conductive layer and the hinge materials are discloses as metal layers (Sections 44, 56 and 68, wherein conductive layer "103", electrodes "140" and hinge material "406" are disclosed as being conductive metal films), but does not specifically disclose that the conductive layer and the hinge material includes aluminum. However, it is well known in the art of conductive films that aluminum metal be used to provide effective electrical conduction. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the conductive layer and the hinge material to include aluminum since it is well known in the art of conductive films that aluminum metal be used to provide effective electrical conduction.

Regarding claims 21, 23, 34, and 36, Ishii et al and Brosnihhan et al disclose and teach of a micro-mirror device and method of manufacturing a micro-mirror device and it is inherent from Ishii et al that the first barrier layer and the second barrier layer are made of either titanium nitride, this being reasonably based upon the barrier layers being disclosed as being made of titanium metal films (Sections 60 and 74, wherein the layers "106" and "406" are made of Ti metal films, Figures 3A-C and 7A-D).

Regarding claims 44-45, Ishii et al and Brosnihhan et al disclose and teach of a micro-mirror device as shown above and Ishii et al further discloses means for protecting the dielectric layer and the at least one electrode from the sacrificial layer, specifically a first barrier layer formed over the dielectric layer and the at least one electrode (Sections 55-60, wherein the first barrier material is "106", Figures 3A-C), and means for protecting the reflective element from the sacrificial layer, specifically a second barrier layer over the sacrificial layer (Sections 74-78, wherein the second barrier material "406" is formed over sacrificial layers "401-405", Figures 7A-D), wherein the sacrificial layer is formed over the first barrier layer (Figures 3A-E), and the reflective element is formed over the second barrier layer (Figures 7A-D), and wherein the second barrier layer, the sacrificial layer, and the first barrier layer are removed after the reflective elements is formed (Sections 74-78, wherein layers "401-405" and sections of "106" and "406" are removed, Figures 7A-D).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hagelin et al and Peeters et al are cited as having some similar structure to the claimed invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jessica T Stultz whose telephone number is (571) 272-2339. The examiner can normally be reached on M-F 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on 571-272-2328. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jessica Stultz
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September 1, 2004

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PRIMARY EXAMINER